

Hyperthermal Nuclear Rocket Environments Simulator



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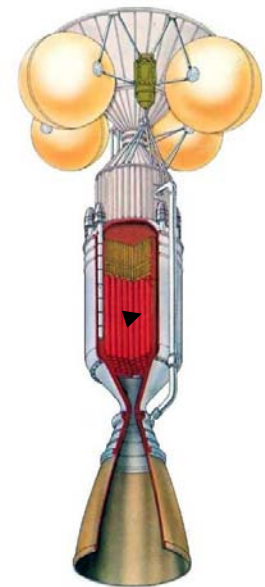
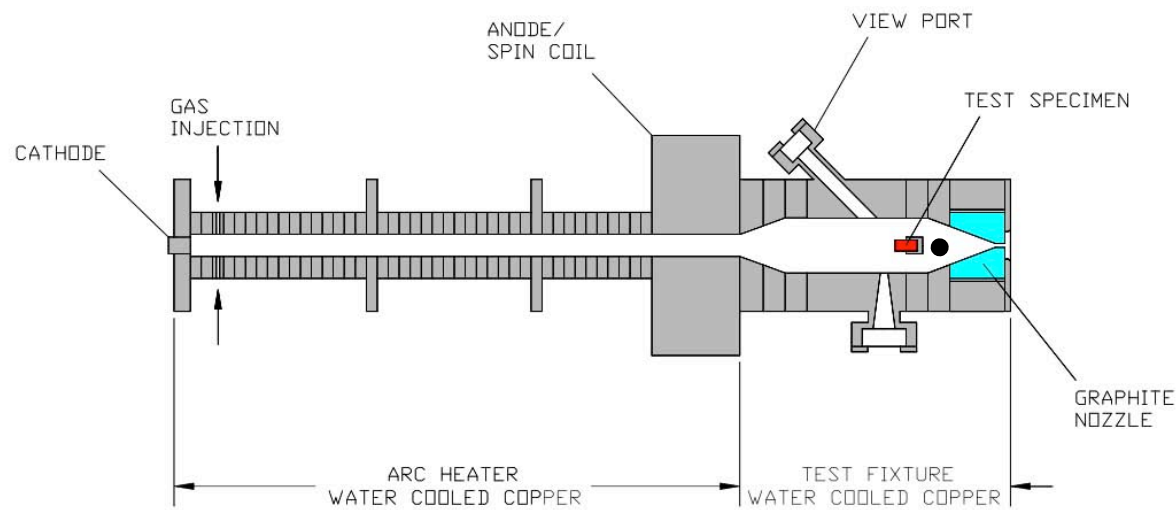
◆ Technology Description

— 1-MW Arc-Heater Driven Hot Hydrogen Non-Nuclear Environments Simulation

- Nuclear rocket reactor core thermal-hydraulics environments traceability
- Long duration exposure of reactor material/fuel specimens
- Evaluation and screening of materials and fabrication/processing techniques

◆ Project Objectives

- Capability Demonstration Testing
- Establish Full Readiness Level
- Design Enhancements for Improved Performance & Operations
- Follow-On Technology R&D Strategy



***Solid Core
Nuclear Thermal
Engine***



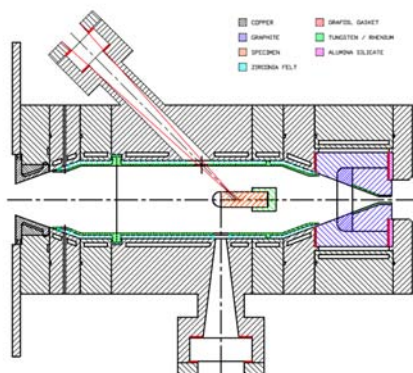
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Capabilities Demonstration Testing

◆ Technical Goals & Objectives

- Validate Hardware & Real-Time Specimen Temperature Monitoring Via Pyrometer
- Realistic Materials Specimen: W-5%Re/40%HfN CERMET
- Performance: High Temperature (2500 – 3000 K) & Long Duration (30 minutes)
- Operations: Multiple Tests / Fast Test Turn-Around (< 2 Hours)

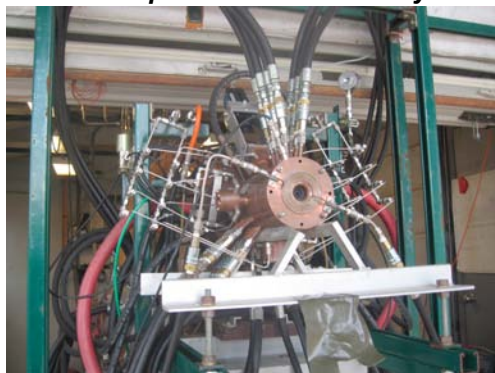
Mark-I Test Fixture Assembly



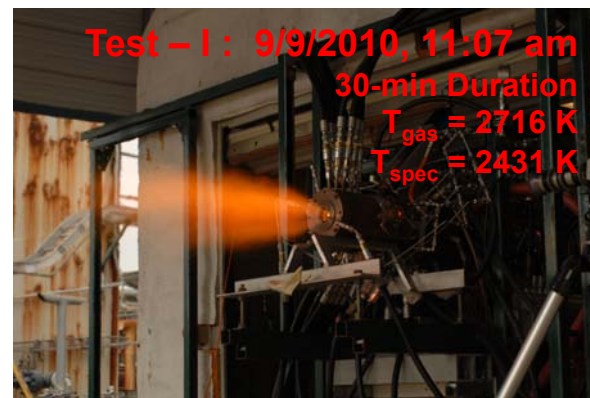
Design Specifications

$P_{\max} = 500$ psi
 $T_{\max} = 3500$ K
 $\dot{m} = 5$ to 10 g/sec
 $d_{\text{bore}} = 2.5$ inches
 $d_{\text{ports}} = 1.5$ cm
 $d_{\text{specimen}} = 0.5$ inches
 $l_{\text{specimen}} = 1.0$ inches

Full-Up Simulator Assembly



Pre-Test CERMET Specimen





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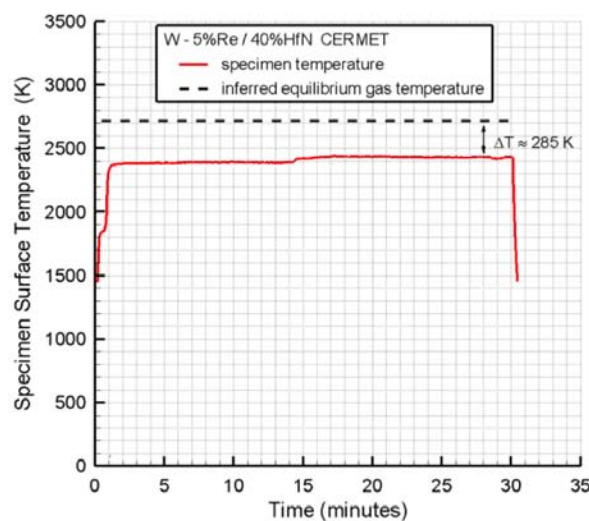
Demonstration Testing Results

◆ Observations & Lessons Learned

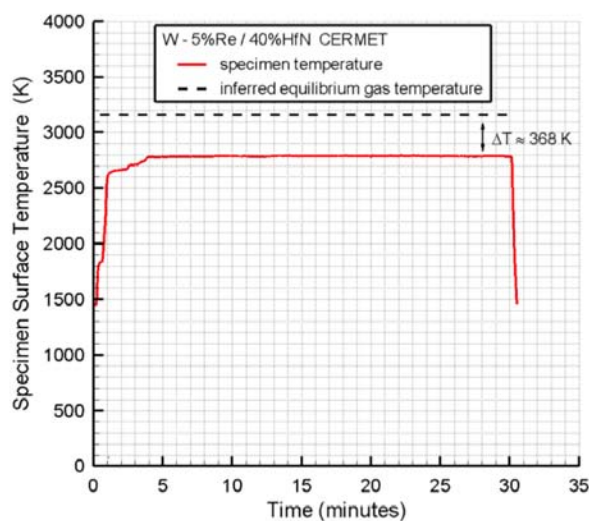
- Hardware Met or Exceeded All Design Requirements
- Excellent Set-Point Operational Stability
- Reliable & Accurate Real-Time Specimen Temperature Monitoring
- Radiation Heat Losses Higher Than Anticipated
- Unexpected Ternary Eutectic Melting of W-5%Re/40%HfN CERMET Specimen
- Enhanced Mark-II Design Recommendations
- Guideposts for Follow-On Technology R&D

Pyrometer Based Specimen Temperature Monitoring Traces

Test - I



Test - II



Post-Test CERMET Specimen

